FOSSIL WOOD OF ANACARDIACEAE FROM THE BRITISH EOCENE

by DONALD W. BRETT

ABSTRACT. Silicified wood from the sands of the Woolwich Series (Landenian) at Herne Bay, Kent, is described as *Edenoxylon aemulum* sp. nov. (Anacardiaceae). The specimen closely resembles wood described from the Lower Eocene Green River Formation of Wyoming, U.S.A., as *Edenoxylon parviareolatum* Kruse. The character of the wood is essentially that of a tropical type with no strongly marked seasonal increments in its radial growth.

THE fossil wood described in this paper is closely similar to the wood of *Edenoxylon parviareolatum* Kruse (1954) which is founded on small stems and roots from the Lower Eocene of Wyoming, U.S.A. The following diagnoses are based on the holotype (stem) of *E. parviareolatum* Kruse, which I have examined, and the new British material which is named *E. aemulum* sp. nov.

Family ANACARDIACEAE
Organ-genus EDENOXYLON Kruse

Diagnosis. Fossil secondary wood, or stems or roots with some secondary wood. Rays of two kinds: narrow 1–2 seriate, and wider fusiform rays containing ducts. Vessels solitary and in radial multiples (2–9), about 50 per sq. mm; diameter 20–140 μ; intervascular pitting typically alternate but opposite in places, minute (about 5 μ); perforations simple, more or less oblique. Wood parenchyma scanty paratracheal. Pitting between vessels and ray cells and between vessels and parenchyma irregularly elliptical, about twice as long as broad, or sub-circular. Remainder of wood tissue narrow fibres, mostly septate.

Type species. Edenoxylon parviareolatum Kruse.

Description of type specimen. Stem about 3 cm. wide with medulla, secondary xylem, and phloem. Vessels about 50 per sq. mm; 20–70 μ diameter. Narrow rays mostly uniseriate, rarely biseriate in part; 2–20 cells high; about 20 per mm. Secondary phloem containing vertical ducts mainly in concentric rows, fibres, and stone cells. (Pl. 61, figs. 1, 2.)

Holotype. B-3280 in Palaeobotanical Collection, University of Cincinnati, Ohio, U.S.A.

Horizon. Lower Eocene of Eden Valley, Wyoming, U.S.A.

Edenoxylon aemulum sp. nov.

Plate 61, figs. 3–7

Diagnosis. Secondary xylem. Vessels about 44 per sq. mm; 30–140 μ diameter. Narrow rays almost all uniseriate nearer centre of axis; further out almost all biseriate and 5–9 cells high, or higher when including uniseriate parts. Rays average about 8 per mm.

Holotype. V44297 in Department of Palaeontology, British Museum (Nat. Hist.), London.

Horizon. Lower Eocene, Landenian; Herne Bay, Kent, England.

[Palaeontology, Vol. 9, Part 3, 1966, pp. 360–4, pl. 61.]

Description. The material consists of several fragments taken from a large piece of silicified wood lying on the beach at Bishopstone, Herne Bay, Kent. Borings through the wood made by a species of *Teredo* are infilled with a greyish sand quite unlike that of the existing beach but matched in the lower beds of the Woolwich Series which overlie the Thanet Sands in the cliffs at Herne Bay. It is deduced from this that the fossil derives from the Woolwich beds.

The wood is diffuse porous. There is an indistinct and irregular periodicity evident in the dimensions of the fibres and vessel chains; and some broader rings have a definite late-wood with smaller and fewer vessels. In transverse section the vessels are solitary and in radial multiples and chains of 2–6 (exceptionally 8); solitary vessels and groups together average 44 per sq. mm.; tangential diameter averages 95 μ but the range is wide, 30–140 μ. Perforations are simple, more or less oblique; intervascular pitting is alternate, about 5 μ. Pits to the ray cells are irregularly elliptical, about twice as long as broad, commonly obliquely inclined or horizontal, or sub-circular and little wider than the intervascular pitting. Pitting between vessels and wood parenchyma is similar to the ray pitting but more commonly horizontal and elliptical (i.e. scalariform). Tyloses fill all the vessels. The fibres are narrow, mostly less than 15 μ wide, thin walled, septate and with dark contents, in strict radial rows forming a uniform tissue. Pits not seen. Wood parenchyma is scanty paratracheal. The rays are of two types, low narrow rays and larger fusiform rays containing radial ducts, together about 8 per mm. (range 6–12). Nearer the centre of the axis the narrow rays are almost uniseriate, 3–16 cells high, and the fusiform rays are only a little higher than the taller of the narrow rays and 3–4 cells wide at the duct. In the more mature wood the narrow rays are almost all biseriate, 5–9 cells high, the rarer uniseriate rays being only 3–4 cells high. Where the biseriate rays include a uniseriate portion they may reach a height of 14 cells. These narrow rays are markedly heterogeneous in cellular composition with a marginal row of square or upright cells and procumbent cells forming the body of the ray. Upright cells frequently occur in the biseriate portions however and included uniseriate portions are of upright cells. The fusiform rays containing ducts are up to 1 mm. high and 0·25 mm. across the widest part of the duct. Occasionally two ducts occur in the ray. The duct is surrounded by 2–3 layers of thin walled procumbent cells much narrower than those of the rest of the ray and with more oblique tangential walls. The cellular composition is otherwise similar to that of the smaller rays. Most of the cells in all types of rays are richly pitted and have dark contents and many show evidence of having contained crystals.

Comparison. The material on which the new species is based differs very little from the wood of *E. parviareolatum*. The vessels of the new species are a little wider and fewer per sq. mm.; the narrow rays are more commonly biseriate and on the whole not so high and are more widely spaced.

Such small variations in vessel size and number, and ray width and height are commonly found between different samples of a single living species in which case they may be the result of differences in the age or size of a tree, conditions of growth, relation to branches, and so on. The scarcity of biseriate rays in the younger wood of the new material accentuates the similarity, since the type specimen is obviously a young stem or branch while the new material consists for the most part of more mature wood.

The possibility that all the material belonged to a single natural species of Eocene

times cannot be excluded. Nevertheless I have felt justified in giving the English specimen a new name, more particularly because the type species includes roots and stems and secondary phloem is present in both. The specific epithet has been chosen to stress the similarities between the new species and the type species.

AFFINITIES OF THE GENUS *EDENOXYLON*

Kruse (1954) placed Edenoxylon in the Anacardiaceae 'without too much confidence' since it could not be identified with any modern genus of the family. My own findings confirm this.

Two families of dicotyledons, the Anacardiaceae and Burseraceae, have wood structure similar to that of *Edenoxylon*. The similarity between the wood of these families is well known and has been put forward as evidence of their close relationship; the families had earlier been united in the Terebinthaceae even before the wood anatomy was well known. More recent studies of wood anatomy have suggested that the Anacardiaceae and Burseraceae should be considered along with the Meliaceae, Sapindaceae, Rutaceae, and Simarubaceae as a single phyletic complex (Heimsch 1942, Webber 1941).

In the Table below are set out some of the more important and variable characters of the wood of the five tribes of the Anacardiaceae and of the Burseraceae and *Edenoxylon*.

	Mangiferae	*Spondiae*	*Rhoideae*	*Semecarpeae*	*Dobineae*	*Burseraceae*	*Edenoxylon*
Vessel multiples	+ chains in few spp.	+ chains rare	+	+	seldom	+ chains in few spp.	+ chains
Banded parenchyma	+	—	rare	extended aliform	—	—	—
Scanty paratracheal parenchyma	few spp.	+	+	—	+	+	+
Radial ducts	+	+	+	1 genus	—	+	+
Septate fibres	1 genus	+	+	—	+	+	+
Opposite inter-vascular pitting	—	1 sp.	some genera	—	+	—	small areas
Unilaterally compound pitting	—	—	—	—	—	+	—

(Data chiefly from Heimsch 1942, Metcalfe and Chalk 1950, Webber 1941.)

+ commonly present in tribe or family; — not reported in tribe or family.

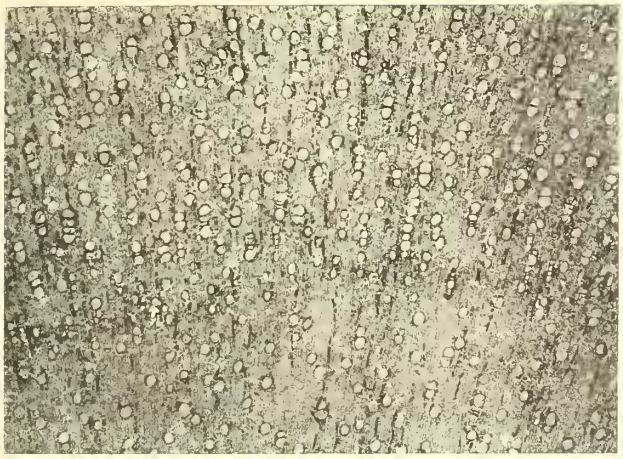
These signs denote presence or absence in *Edenoxylon*.

It will be seen that considering distribution of wood parenchyma and the occurrence of septate fibres and radial canals, *Edenoxylon* has most in common with the Spondiae and Rhoideae of the Anacardiaceae and with the Burseraceae. The Burseraceae however are usually readily distinguished by the unilaterally compound pits communicating between vessels and ray cells. Furthermore the presence of small areas of opposite intervascular

EXPLANATION OF PLATE 61

Figs. 1, 2. *E. parviareolatum*. 1, Transverse section of secondary wood of holotype; ×20. 2, Longitudinal section of same, mostly tangential, more or less radial to the right; ×20.

Figs. 3–7. *E. aemulum*. 3, Tangential section showing a large fusiform ray with duct; some narrower rays and vessels filled with tyloses are also shown; ×70. 4, Transverse section showing vessel multiples and numerous narrow rays, ×35. 5, The same at higher magnification showing 2- and 3-seriate rays and the uniform tissue, probably mainly septate fibres, between the large vessels; ×120. 6, Intervascular pitting on vessel wall; the arrangement is seen to be irregularly alternate; ×500. 7, Radial longitudinal section; ×70.



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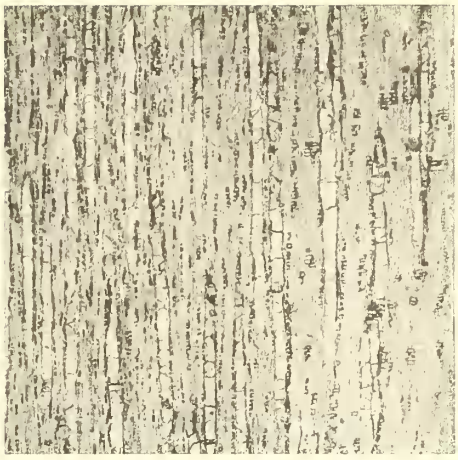

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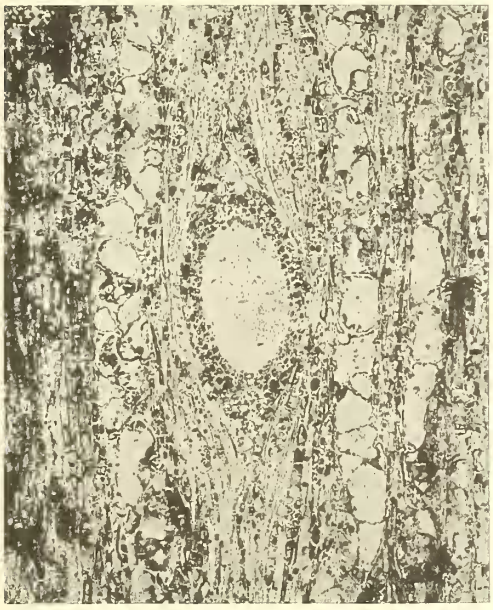

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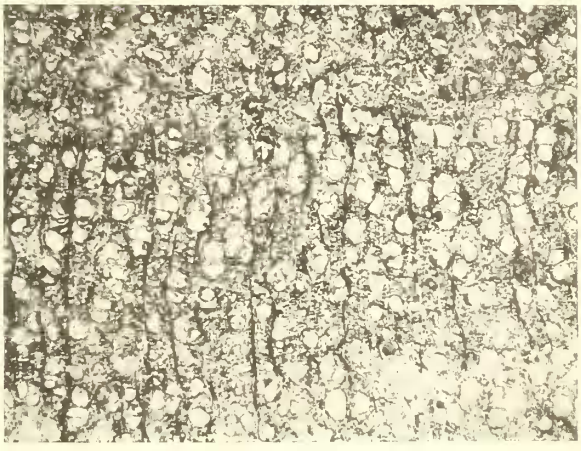

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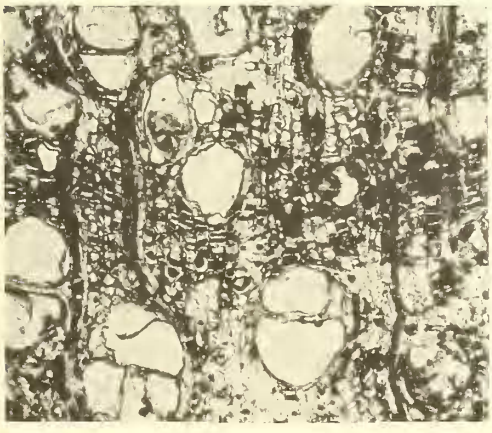

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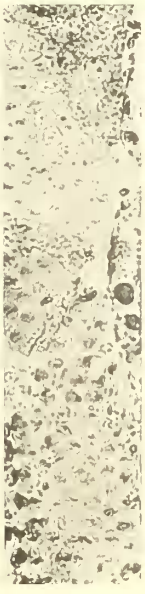

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BRETT, Wood of Eocene Anacardiaceae